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## THE MIGRATIONS OF CERTAIN SHORE BIRDS.

BY AUSTIN H. CLARK.

THE object of this paper is to explain, in as brief terms as possible, what I consider is the main factor by which many of our shore birds are guided in their migrations. I refer especially to those species which pass southward over the western Atlantic, from the eastern Canadian Provinces, past the Bermudas and the easternmost of the West Indies to South America, as far south as Patagonia, and return by way of Central America and the Mississippi Valley. The bird which I have chosen as the best representative of this class, and with which I shall mainly deal, is the Golden Plover (*Charadrius dominicus*), as it is large, well known, easily identified (even when passing over at night), and does not occur commonly, as do many other species (for instance the Spotted Sandpiper, *Actitis macularius*, the Turnstone, *Arenaria interpres*, and the Yellow-legs *Totanus flavipes*), in the southern part of its range at all seasons.

Briefly summarized, the route taken by this plover in its migrations (*vide* Cooke, Yearb. Dept. Agriculture, 1903, p. 371) is as follows:—Starting from the breeding grounds in western Arctic America, it goes to Labrador (arriving in August) where it fattens on the ‘curlew berries’ which are ripe at that time, and then travels southward, leaving the continent at Nova Scotia, over the sea past (sometimes four hundred miles or more east of) the Bermudas, then just east of and over the Lesser Antilles, reaching South America at the Guianas and the northernmost coast of Brazil (about the first of September). It soon disappears, but reappears again on the prairies of Argentina, and goes as far south as Patagonia, where it remains from September to March. In March it appears in northwestern Colombia, Panama, and Central America, passes up the Mississippi Valley, reaches the prairie regions of the United States in April, crosses into Canada in May, and is back on its breeding grounds in June.

The question naturally arises, why do the birds come north by a different route from that taken going south, and what guides them in their long sea journey from eastern Canada over the Atlantic to the Guianas?

As long ago as 1848, Sir Robert H. Schomburgk made the interesting observation (Hist. Barbados, p. 681) that these plover, in common with other shore birds, when flying over the island of Barbados (the most easterly of the West Indies) take a course from northwest to southeast, at right angles to the direction of the wind (the northeast trade). Col. H. W. Feilden, in writing of the birds of Barbados (Ibis, 1889, p. 490; West Indian Bulletin, III [1902], p. 343), also notes this fact adding that "it appears to be a well established observation that birds prefer migrating with a 'beam' wind." When in Barbados in September, 1901, I was told by several sportsmen that the shore birds were always seen to pass the island flying from northwest to southeast, and I observed the fact myself in the migration seasons of 1903 and 1904.

Thus it appears that within the trade-wind belt, at least, these birds always direct their flight in a definite relation to the direction of the wind. With us, living in the north temperate zone, the winds are so irregular and variable that we can hardly form any accurate idea of the regularity of the winds within the tropics, and to a lesser extent, over the sea in general, unless we have had more or less experience with them.

Acting upon the supposition that the invariable relation of the flight of the Golden Plover to the direction of the wind when in the West Indies might be in reality a key to the course taken by them during the major part, if not the entire extent of their flight, I have mapped out a theoretical course which the birds would follow, provided they depended on the direction of the wind as a guide, and flew always at right angles to it.

There is one important point to be borne in mind in connection with this, and that is that a bird flying directly across a wind will be carried to leeward out of the course it appears to be taking just as many miles every hour as the force of the wind is miles per hour. I may illustrate what I mean by a parallel case. If a man were to row a boat at the rate of four miles an hour across a stream with a current of two miles an hour, which (let us assume) it takes him an hour to cross, if he rows always with the axis of the boat at right angles to the force of the current, he will reach the other bank at a point as far down stream from a position exactly

opposite the place from which he started, as the current of the stream will have gone on during the time he took in crossing. In the case given, he would be two miles below the position opposite the starting point, as the stream had a current of two miles per hour, and he took an hour to get across. In the same way, assuming the flight of Golden Plover to be one hundred miles an hour, and the strength of the wind which it is crossing to be thirty miles an hour, in one hour's flight, the plover would have reached a point one hundred miles from where it started, but thirty miles to the leeward of a line drawn from the starting place at right angles to the wind. Thus in calculating the course which would be taken by birds, provided they relied on the wind for a guide and flew at right angles to it, we must remember that the direction taken is in reality more or less diagonally across it (depending on the strength of the wind) although the birds are all heading directly across it.

Starting from their breeding grounds in western Arctic America, the course of the Golden Plover would be southeasterly across the prevailing southwest winds, which would bring the birds across north central and northeastern Canada to Labrador, and the eastern Canadian Provinces (New Brunswick and Nova Scotia). This may be considered the first stage of their flight. It is interesting to notice here that the Whimbrel (*Numenius phaeopus*) and the Ring Plover (*Ægialitis hiaticula*) which breed in Greenland and about Cumberland Gulf also in migrating fly across the prevailing southwesterlies of the north Atlantic, which brings them to the shores of Europe and Africa, instead of down the American coast, as it might be supposed they would come. As a matter of fact, the Whimbrel is unknown on the eastern sea-board of the United States, while the only record for *Ægialitis hiaticula* in America (south of its breeding grounds) is Barbados (September 10, 1888), to which island a number of European birds (for instance *Pavoncella pugnax*, 1848 and 1878, *Vanellus vanellus*, 1886, *Hydrochelidon leucoptera*, 1888, and *H. hybrida*) have strayed.

Mr. William Brewster believes that the Whimbrel and *Ægialitis hiaticula* in eastern Arctic America are merely colonies, the birds from which would most naturally go south during the migrations by the route taken by others in the European habitat of the spe-

cies; and the fact that they cross over to Europe and then proceed to southern Africa instead of going to southern South America is merely due to their starting on their journey by the same route by which they originally reached the territory. This, however, is not so serious an objection as might at first sight appear; for very possibly the species were first established in those regions by certain individuals or companies getting off the main track of the migrations north along the coasts of Africa and Europe, and, directing their course from perhaps northwestern Africa across the prevailing southwesterly winds (in the spring), finally reaching land in Greenland and the regions immediately to the west of it.

Starting from Labrador and the eastern Canadian Provinces, the Golden Plover would fly in a southeasterly direction, across the prevailing southwesterly winds until the latitude of Bermuda was reached. This would bring them to a point a few hundred miles to the eastward of those islands. Here the course would change to westerly, and then southwesterly in the 'horse latitudes.' The variable and rather light winds which occur here at this season would tend to scatter the flocks somewhat, and we should expect the line of migration to be somewhat wider from this point south. The prevailing southeasterly, then easterly winds in the 'horse latitudes' would cause them to go first in a southwesterly direction, becoming more southerly as the northern limit of the northeast trades was approached. They would begin to feel the effects of the trades in a position due east of the Bahamas, and due north of Porto Rico. Their course would then change from southerly to southeasterly, and they would pass along just to the eastward of, and over, the Lesser Antilles, reaching northern South America in the Guianas. At the season when the birds reach the Guianas, the wind in that district is very light, but what little there is comes from the east. Here they stop and feed (being in a very lean condition after their long flight) and appear, from what I can learn from people who have travelled in the interior of British Guiana, to follow up the rivers into the higher land.<sup>1</sup>

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<sup>1</sup> There is a specimen in the British Museum from Mt. Roraima, and one from the Maroni River, Surinam.

From this point their course is not accurately known ; but if we apply this theory, they would follow down the northeastern tributaries of the Amazons until they came within the influence of the southeast trades, which would carry them southwest, over central Amazonia toward Peru and Bolivia.<sup>1</sup> Somewhat northwest of the Matto Grosso region, the birds would come under the influence of the easterly winds on the southern border of the trades, which would turn them south, and gradually (as they became more northeasterly) southeast, which would bring the plover into the prairie region of the Argentine. Here the prevailing westerlies of the pampas region would be felt, and the birds would, under their influence, continue down the eastern part of Patagonia toward Tierra del Fuego.

In returning, the birds would first go north (across the prevailing westerlies), until in the vicinity of Buenos Ayres, and the country just to the west of it where they would encounter northeasterly winds, which would turn them inland, up the valley of the La Plata and along the plains to the east of the Andes, the course gradually becoming more northerly, and then northeasterly in the area covered by the southeast trades. They would reach the Amazons valley in its western half, and then under the guidance of the northeast trades fly northwest, toward the isthmus of Panama and Central America. The course from here would be northwest across the trades to Texas and the Mississippi Valley. The birds follow up this valley, northward, and then, on reaching Canada fly northwest, across the prevailing southwesterly and westerly winds to their breeding grounds in western Arctic America.

This, then, would be the path travelled by the main flights of the Golden Plover. Those flocks which visit the lakes of Maine and the eastern seacoast of the United States may very well be parties which have become detached from the main body, perhaps during a period of squally weather, with uncertain and variable winds, conditions very liable to occur at the time of their journey south.

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<sup>1</sup> There are specimens in the British Museum from Peru taken in September and October.

Col. Feilden remarks (Ibis, 1889, and West Indian Bulletin, III, [1902], *loc. cit.*) that "a shift of wind from the northeast, with squally weather to the southeast is ardently longed for by the Barbados sportsmen towards the end of August, as this forces the migratory hosts [of shore birds] to alight instead of passing over at a great height, as they are seen to do when the wind is from the northeast."

Along the coast of Cape Cod, Massachusetts (where the wind should be west or southwest to favor their flight), the gunners have observed that numbers of Golden Plover sometimes appear if the wind happens to be northeast at the time they are passing; but if the wind shifts to the southwest, they all disappear. These two instances seem to offer additional evidence that the birds are to a considerable degree reliant on the direction of the wind to guide them in their flight.

Mr. Brewster believes that the knowledge that an immense supply of food awaits them in Labrador would be more potent in bringing the plover to that district than the direction of the wind. Here, as in the case of the parallelism between the course taken in the first stage of the migration by Golden Plover, and by the Whimbrel and *Aegialitis hiaticula*, the result would be the same, no matter which was the true cause; but it seems to me that the question of food cannot influence these plover, as, although the old birds may remember the attractions of Labrador in regard to food, the young of the year, which have never seen the place could hardly be influenced in the direction of their flight by any such considerations, and in this species the young and old do not migrate together, but the first to arrive at any given point are invariably adults, and nearly all males; next come the females, and, about twelve days after the main flight of the adult males, the light-breasted young. It may, of course, be argued that the old males lead the way, followed by the females and the young; but it seems more probable that all are guided by the same cause, as otherwise we should expect the young, if they should for a few days lose sight of the others, to get off the track and turn up at places remote from the usual path of migration, a thing which they are no more liable than the adults to do.

Of course it is probable that in wide and rich valleys, like those

of the Mississippi and La Plata, and to a lesser extent the rivers of the Guianas and the northeastern tributaries of the Amazons, the birds are guided largely by their direction, and the courses of the streams; but it seems as if outside of these areas, we must look for the key to the course of their flight in the direction of the winds, as by no other method can we satisfactorily explain (1) why they pass over the West Indies always from northwest to southeast, (2) why they are usually observed to migrate with a 'beam' wind, (3) why they never alight on Barbados or the other West Indies if the wind is northeast, but only if it comes from the southeast or some other direction, not necessarily contrary to their course, (4) why they appear on the Massachusetts coast during northeast winds, but leave if the wind changes to the southwest or west, and (5) why they reach the South American continent in the Guianas on their journey south, but leave it at the isthmus of Panama in coming north.

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## LIST OF BIRDS SEEN IN JEFFERSON PARISH, LOUISIANA, APRIL 1, 1904.

BY H. H. KOPMAN.

THE following list of 64 species seen by the writer and two companions, Messrs. Andrew and W. B. Allison, during an extended walk near New Orleans, April 1, 1904, presents the typical bird-life of the section at that season with an unusual degree of closeness to what might be considered the ideal typical state of the avifauna. The season was absolutely normal, no extremes of cold having occurred during the winter, and the spring having developed slowly but practically uniformly from small beginnings after the first week in January, and more rapidly and without the slightest interruption from the cold, after the 20th of February.

Because the list gives a typical view of our bird-life at the season in question, and because it is the largest Louisiana list of